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## **Periodic annual DBH increment in a subtropical moist forest dominated by** Syzygium jambos **(L) Alston.**

**Sumario.** **Syzygium jambos**, a pesar de la presencia de árboles de mayor tamaño, y el hecho de que el bosque fue sometido a una entresaque para eliminarla, mantenía aproximadamente la misma proporción de tallos y área basal durante 32 años, principalmente como árboles intermedios y suprimidis. La especie produce una fruta comestible, regenera por rebrotes después de podarse, y crece en zonas de suelos pobres, características las cuales lo hacen recomendable para programas agri-silviculturales

### *Introduction*

The Río Piedras Woodlot on the north coast of Puerto Rico is a secondary forest in the Subtropical Moist Life Zone (2). The woodlot is located on shallow tuffaceous soils (4) at about 40 m elevation, areas which generally accord to Beard's (1) classification for semi-evergreen seasonal forest. Mean annual rainfall exceeds 1900 mm with no monthly mean less than 70 mm. Mean temperature is about 25°C and varies little throughout the year

A single 0,5 ha plot was established to record annual dbh increment (periodic annual increment, PAI) by species, and to observe growth of the coppicing tree *Syzygium jambos* (L.) Alston on low elevation, shallow soils.

Methods — In 1943, 96 stems $\geq 4.0$ cm were measured (on a 0.05 ha plot). The stand had three stories, with *B. divaricata*, Z. martinicense and *S. mombin* in the canopy, species common on drier sites within the life zone. All stems were $<35$ cm dbh, and the basal area was 11.7 $m^2$/ha.

An improvement cutting in 1953 removed 25 per cent of the stems and 33 per cent of the basal area. The cutting concentrated on *S. jambos*, *C. guianensis*, *C. arborea*, Melastomataceae, *D. morototoni*, *S. mombin*, and *M. splendens*, principally suppressed trees of small dimension. The woodlot was remeasured in 1975. Tukey's omega procedure, a multiple range test, was used to determine significant PAI difference by crown class.

### *Results and Discussion*

Wadsworth (6) concluded that *S. jambos* seedling growth was slow but sprout growth was phenomenal, producing a dense stand within a few years. He cited a 6-year old coppice stand in Cidra, Puerto Rico, with 50,000 stems/ha and 42 $m^2$/ha growing stock yielding an estimated 11 to 14 $m^3$/ha/yr. Stumps were still vigorous after four cuttings. He concluded that *S. jambos* could provide small dimension wood products useful to a rural population as well as establish itself as a weed difficult to eradicate. He also observed that the species grew well on some of Puerto Rico's worst soils and produced shade so dense that subordinate vegetation could not develop, causing soil erosion on steep slopes.

During the 32 year observation of the Río Piedras Woodlot, the total number of stems decreased from 1920 to 1200/ha while the basal area increased from 11.7 to 14.9 $m^2$/ha. About 90 per cent of the natural and man-caused stand mortality was in the 5 and 10 cm classes (Table 1).

*S. jambos*, a species that rarely exceeds 20 cm dbh, comprised about 25 per cent of the stems and 20 to 25 per cent of the basal area in 1943 and 1975. Much of both ingrowth and mortality was also attributed to this species.

The stand had 16 species in 1943 and 11 in 1975 (Table 1). Seven secondary species present in 1943 were absent by 1975; two climax species absent in 1943 comprised 25 per cent of the stems and 13 per cent of the basal area ingrowth by 1975

In 1943, 55 per cent of the stand basal area was in the 10 cm dbh class; by 1975, 45 per cent in the

40 cm class In 1943, nearly 50 per cent of the stems were in the intermediate crown class (Figure 1). After selective thinning of suppressed stems in 1953, regeneration by coppicing *S. jambos*, and other species, principally *I. ferrea* and *F. occidentalis,* resulted in 70 per cent of the stems in the suppressed crown class by 1975.

PAIs by crown class for all stems that survived from 1943 to 1953 were compared (Figure 2). Significant differences were found, with the dominant class growing faster than the suppressed class. PAIs by species with four or more individuals that survived the same interval were plotted (Figure 2). Only *P.*

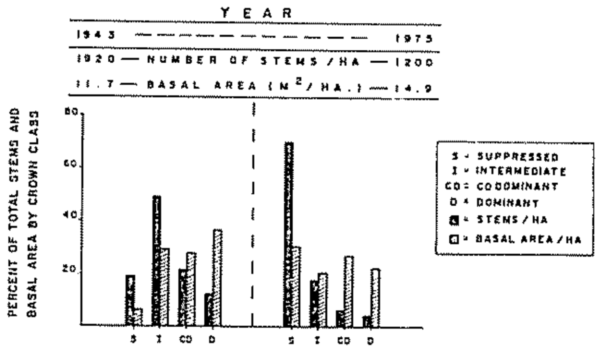


Fig. 1.—*Number of stems and basal area by crown class*

Table 1.—Species dominance by density (stems/ha) and basal area ($m^2$/ha) in 1943 and 1975.

| Species | 1943 Nº stems | 1943 BA | 1975 Nº stems | 1975 BA | Ingrowth 1943 to 1975 Nº stems | Ingrowth 1943 to 1975 BA | Natural and Man-Caused Mortality by dbh class, 1943 to 1975[1/] 5 | 10 | 20 | 40 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Nº stems | | | |
| *Syzygium jambos* (L.) Alston [a/] | 500 | 2.20 | 440 | 3.90 | 280 | 2.06 | 140 | 200 | —— | —— | 340 |
| *Casearia guianensis* (Aubl.) Urban [a/] | 280 | 0.57 | 20 | 0.11 | —— | —— | 200 | 60 | —— | —— | 260 |
| *Phoebe elongata* (Vahl) Nees [b/] | 200 | 2.89 | 80 | 2.76 | —— | —— | —— | 40 | 60 | 20 | 120 |
| *Casearia arborea* (L. C. Rich.) Urban [a/] | 200 | 0.76 | 100 | 1.34 | 60 | 0.63 | 40 | 120 | —— | —— | 160 |
| *Guarea trichillioides* L. [b/] | 140 | 1.30 | 140 | 2.94 | 80 | 0.27 | 20 | 40 | 20 | —— | 80 |
| *Inga laurina* (Sw.) Willd. [b/] | 140 | 0.95 | 60 | 2.38 | —— | —— | —— | 80 | —— | —— | 80 |
| *Andira inermis* (W. Wright) H. B. K. [b/] | 80 | 0.38 | 60 | 0.61 | —— | —— | —— | 20 | —— | —— | 20 |
| *Vitex divaricata* Sw. [b/] | 80 | 0.29 | —— | —— | —— | —— | 20 | 60 | —— | —— | 80 |
| *Melastomataceae* [a/] | 80 | 0.16 | —— | —— | —— | —— | 60 | 20 | —— | —— | 80 |
| *Didymopanax morototoni* (Aubl.) Decne. & Planch. [a/] | 60 | 1.13 | —— | —— | —— | —— | —— | —— | 60 | —— | 60 |
| *Ocotea leucoxylon* (Sw.) Mez [b/] | 60 | 0.30 | 20 | 0.03 | 20 | 0.03 | —— | 60 | —— | —— | 60 |
| *Zanthozylum martinicense* (Lam.) DC. [b/] | 20 | 0.42 | —— | —— | —— | —— | —— | —— | 20 | —— | 20 |
| *Spondias mombin* L. [a/] | 20 | 0.20 | —— | —— | —— | —— | —— | 20 | —— | —— | 20 |
| *Myrcia splendens* (Sw.) D.C. [a/] | 20 | 0.10 | —— | —— | —— | —— | —— | 20 | —— | —— | 20 |
| *Symplocos martinicensis* Jacq. | 20 | 0.04 | —— | —— | —— | —— | 20 | —— | —— | —— | 20 |
| *Ixora ferrea* (Jacq.) Benth. | 20 | 0.03 | 100 | 0.33 | 100 | 0.24 | 20 | —— | —— | —— | 20 |
| *Faramea occidentalis* (L.) A. Rich. | —— | —— | 160 | 0.43 | 160 | 0.43 | —— | —— | —— | —— | —— |
| *Buchenavia capitata* (Vahl) Eichl. | —— | —— | 20 | 0.06 | 20 | 0.06 | —— | —— | —— | —— | —— |
| Total | 1920 | 11.72 | 1200 | 14.89 | 720 | 3.72 | 520 | 740 | 160 | 20 | 1440 |

1/ dbh classes: 5 cm (4.0-6.5 cm), 10 cm (6.6-14.1 cm), 20 cm (14.2-26.8 cm), 40 cm (26.9-54.6 cm).
a/ Species selectively removed in 1953 thinning
b/ Species favored in 1953 thinning

Table 2.—PAI (cm/yr) by species for trees surviving 1943 to 1975 and range of DBH (cm) by species in 1943.

| Species | PAI 1943-53 | PAI 1953-75 | 1943-75 Statistics Mean | CV (%)1/ | N2/ | DBH Range 1943 |
|---|---|---|---|---|---|---|
| *Syzygium jambos* (L.) Alston | 0.14 | 0.13 | 0.13 | 38 | 10 | 5—8 |
| *Casearia guianensis* (Aubl.) Urban | 0.11 | 0.06 | 0.07 | 29 | 2 | 5 |
| *Phoebe elongata* (Vahl) Nees | 0.66 | 0.21 | 0.33 | 50 | 4 | 10—20 |
| *Casearia arborea* (L. C. Rich.) Urban | 0.38 | 0.26 | 0.30 | 24 | 2 | 5 |
| *Guarea trichillioides* L. | 0.40 | 0.35 | 0.37 | 46 | 3 | 5—12 |
| *Inga laurina* (SW.) Willd. | 0.59 | 0.23 | 0.34 | 24 | 3 | 10—12 |
| *Andira inermis* (W. Wright) H.B.K. | 0.18 | 0.08 | 0.10 | 114 | 3 | 5—8 |
| Total | 0.31 | 0.18 | 0.22 | 70 | 27 | 5—20 |

1/ CV = Coefficient of variation

2/ N = Number of individuals

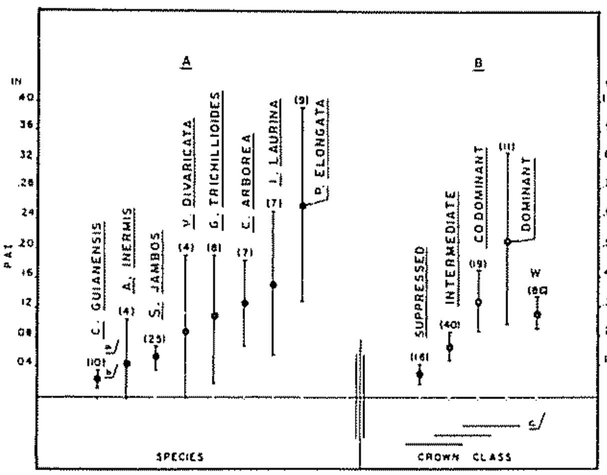


Fig. 2.—*Secondary woodlot dominated by* S. jambos
*Part A - PAI by species*
*Part B - PAI by crown class for all stems and PAI for all stems regardless of crown class* (Σ)

a/ Numbers above vertical lines indicate the number of replications.

b/ Vertical lines indicate the 95% confidence limits above and below the means

c/ Horizontal lines indicate multiple range comparisons of means.

*elongata* exceeded 0.40 cm/yr. Statistical comparisons were not conducted because replications were inadequate.

PAIs by species for trees surviving the 32 years ranged between 0.07 and 0.37 cm/yr (Table 2). Fastest rates were attained by the species with the largest dbh in 1943.

A comprehensive interpretation of thinning effects was impossible because of the lack of a control plot.

## *Conclusions*

Despite the presense of larger stems on the plot and a thinning to remove the species, *S. jambos* maintained approximately the same proportion of stems and basal area for 32 years, principally in the intermediate and suppressed crown classes. The species is small and should not be favored in areas managed for large-dimension products. The species could, however, offer agri-silviculture benefits in areas with poor soils. The fruit is edible and the wood can be of great service in wood-starved intensive farming regions (6).

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## Note on 2n-3n incompatibility in *Coffea canephora*

**Sumario**. Cruzas dialélicas entre clones de café de altos rendimientos de la serie Balehonnur Robusta (BR), indicaron un caso de incompatibilidad entre el embrión y el endospermo. Se sugiere que la falta de armonía en el endospermo pero no en el embrión es debida a que el tejido contenía dos juegos de cromosomas maternos y sólo uno paterno

In higher plants, hybrid inviability is often due to causes other than incompatibility between the parental chromosomes as they affect the embryo itself. This fact has been proved by Laibach, as cited by Stebbins (2), who found that the crosses between *Linum austriacum* and *L. Perenne* did not yield viable seeds. But he still managed to obtain hybrid plants of the same cross by embryo culture. Thus the production of hybrids by embryo culture from otherwise incompatible matings has now become common and number of hybrids has been produced. There are numerous examples in the literature on embryo and endosperm incompatibility in angiosperms.

Self-sterility in *C. canephora* has been studied by Dexreux *et al* (1), and it has been established that the failure of the seed set on selfing is due to the failure of the pollen tube growth in the style at various levels leading to self-sterility.

Diallelic crosses were effected in 1976 at the Central Coffee Research Institute using high yielding clones in B. R. (Balehonnur Robusta) series, *viz*, BR 9, BR 10, and BR 11 from S. 274 line and BR 4 and BR 5 from S 270 line. Wherever the set was low and seed germination was a failure the crosses were repeated in 1977. The details of the experiment and the results will be published elsewhere.

Diallelic crosses involving clone BR 11 as female parent have not only yielded low set when compared to its reciprocal crosses but also the seeds failed to germinate. Poor germination was also noticed in open pollinated seeds of the clone BR 11 as shown in Table 1. Clone BR 11 as male parent yielded viable seeds and normal progenies have been established in the field. Thus BR 11 as male parent with higher compatibility with other clones is a good pollinator.

On examination the ungerminated seeds (both crosses and open pollinated) were found to be complete but the embryos were found arrested in growth. Very few seeds germinated and in most of the cases the embryo failed to emerge and those emerged dried up at various stages (Table 1, Fig 1).

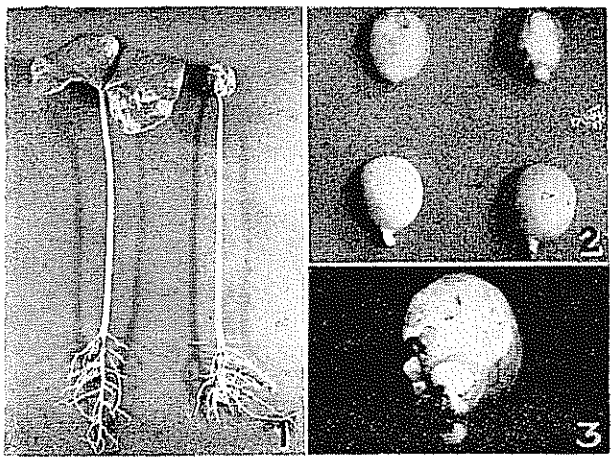


Fig 1.—A case of normal seedling growth when BR 11 is male parent (65 days)

Fig. 2 —Abnormal germination (Failure) of seeds when BR 11 is female parent, embryos arrested as also dried up (65 days)

Fig 3 —Ebryo exposed to show the limted development of the Cothyledons (65 days).